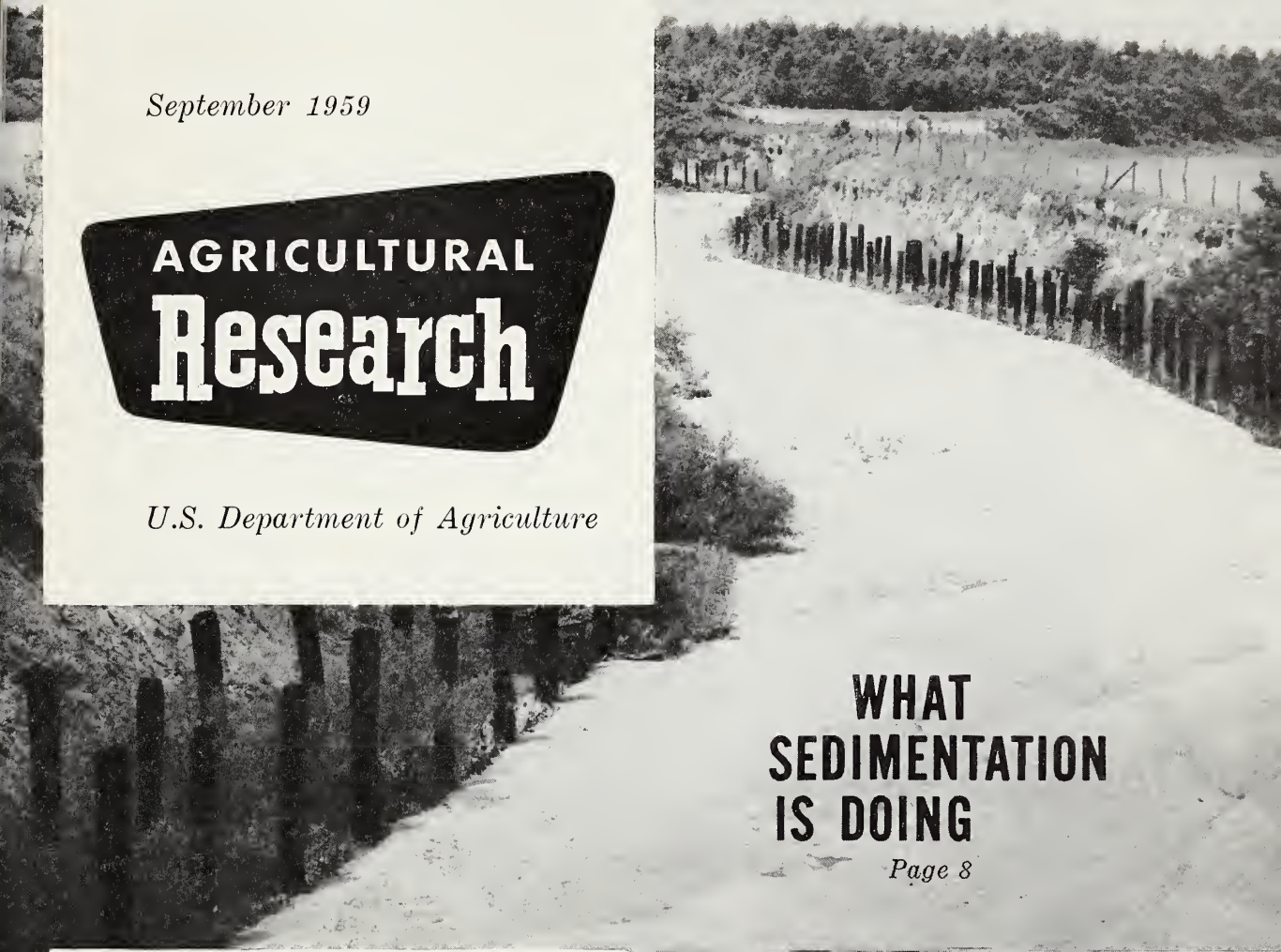
September 1959

AGRICULTURAL Research

U.S. Department of Agriculture



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AGRICULTURAL
Research

Vol. 8—September 1959—No. 3

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Partnership

This country's agricultural research owes much of its great success to cooperation: private industry works jointly with publicly supported institutions—State and Federal—to serve farmers, aid processors and marketers, and benefit consumers.

Some 30,000 scientists labor in this industry-State-Federal partnership at locations in every State and Territory.

USDA research expenditures for the fiscal year 1959 were about $128 million, nearly $32 million of it for Federal grants to State experiment stations. These stations had an estimated $108 million from State appropriations and other sources. So the State-Federal expenditures for agricultural research ran about $236 million. It's estimated that industry spends a roughly equal amount—heavily concentrated in processing and marketing, though substantial funds are spent also on agricultural chemicals and biologics, and farm equipment.

So funds available to the partnership total nearly half a billion dollars—enough to support a sizable, effective effort.

Yet, this is less than 5 percent of the country's $10-billion effort in research and development. In 1940, agriculture received 40 percent of all *Federal* funds for research and development: today, the figure is only 2½ percent.

It's therefore important—considering agriculture's basic place in the economy—that we use our resources as effectively as possible. Fortunately, a variety of arrangements helps scientists in the partnership keep in touch with each other.

About 90 percent of USDA research is cooperative with other organizations—primarily the State stations, but also including other State and Federal agencies, industry, institutions and universities, farm organizations, trade associations, and other groups. Then, some 200 contracts with private organizations and public institutions enable us to use some of the country's best scientific manpower. Grants play an important part in cooperative research, as do such arrangements as memoranda of understanding, endowments, and fellowships. Furthermore, industry makes facilities, materials, and services available.

Thus, all three partners have had a hand in most of the significant research developments in agriculture in recent years.

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BEEF

Our cattle numbers have increased in step with growth of population, but we're eating more beef per person due to efficiency gains

Farmers and ranchers will find it advantageous, in USDA's view, to hold cattle production in the years ahead to an orderly increase. Failure to realize how fast our production efficiency is gaining could lead to overexpansion in cattle numbers.

■ Beef production, steadily on the rise for many years, just about doubled in the past three decades alone—not a particularly suprising fact. It is surprising, however, that only half this enormous increase is due to increasing numbers of cattle in our inventory at any one time. The other half is due to greater productivity—more beef pro-

TURN PAGE

HOW WE GOT OUR EXTRA BEEF

(Continued)

duced per head in the country's overall "national herd."

This, of course, is a tribute to the efficiency of cattle research. Our cumulative advances, through breeding, feeding, disease, and parasite studies, have given us today's improved animals.

Growing cattle numbers have just kept pace with our growing population, according to a survey by USDA's Agricultural Marketing Service. Each increased 43 percent in the last 30 years. If beef output were geared to numbers alone, consumers would be getting no more beef per capita than 30 years ago. But the production of beef per head also increased—by 44 percent—so consumers now eat more beef per capita.

Many factors contributed to our gains

What has caused this gain in production? AMS economist Harold Breimyer explains it this way:

For one thing, a growing percentage of slaughter cattle are beeves, rather than lighter dairy cattle.

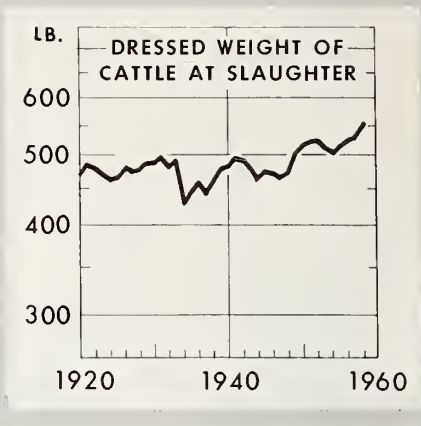
Moreover, steers and heifers are now raised faster and slaughtered earlier than ever before. This fast turnover of greater numbers of steers and heifers means more beef per year relative to inventory.

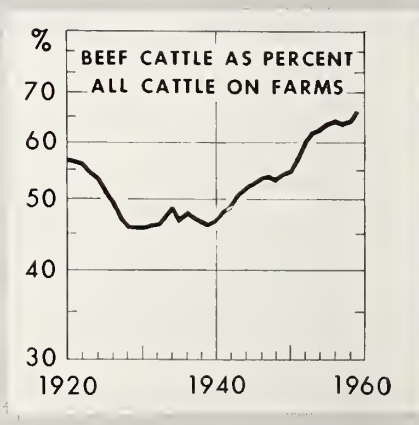
Another reason for higher beef production is the higher birth rates and lower death losses for calves. Calf births per 100 cows have increased from 75 per year in the mid-1920's to 87 in the past few years. This increase was achieved despite the shift from milk cows to beef cattle, which are less reliable as breeders.

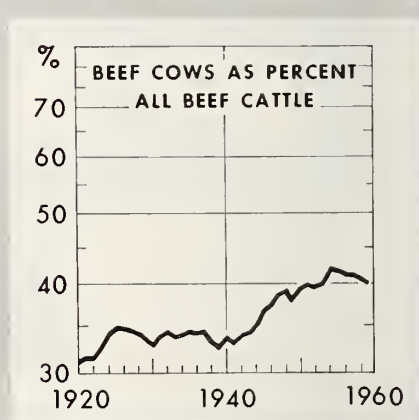
One of the best ways to increase production is to put extra weight on animals to be slaughtered. This has been done in two ways: (1) by keeping more animals to maturity for slaughter (70 percent now, compared with 60 percent in the 1920's and 1930's), and (2) by feeding out more and more cattle. Dressed weight has increased 80 pounds per head. Some people question the desirability of such a heavy increase.

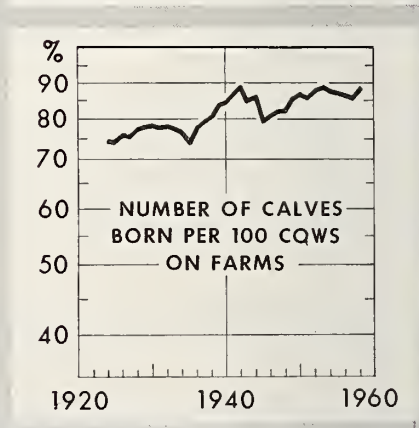
These historical facts also bear on the future. Just now, the cattle industry is again on the upturn after the 1956–57 decline. This alone will increase our beef supply. But if we continue to get more beef per animal, as seems likely, beef production will go up more than would be indicated by increase in herds alone.

For instance, if cattle numbers alone should go up from 100 to 110 million in the next 5 years, production would probably rise from the present 14½ to about 17 billion pounds of beef per year—half the increase through higher productivity per head.☆









Larger market is foreseen for soybeans and flaxseed through development of oil derivatives, known as vinyl ethers, with much potential as

Tough, Flexible COATING Materials

PROMISING film-forming materials that adhere well to metals have been made from soybean and linseed oils by USDA chemists at Peoria, Ill.

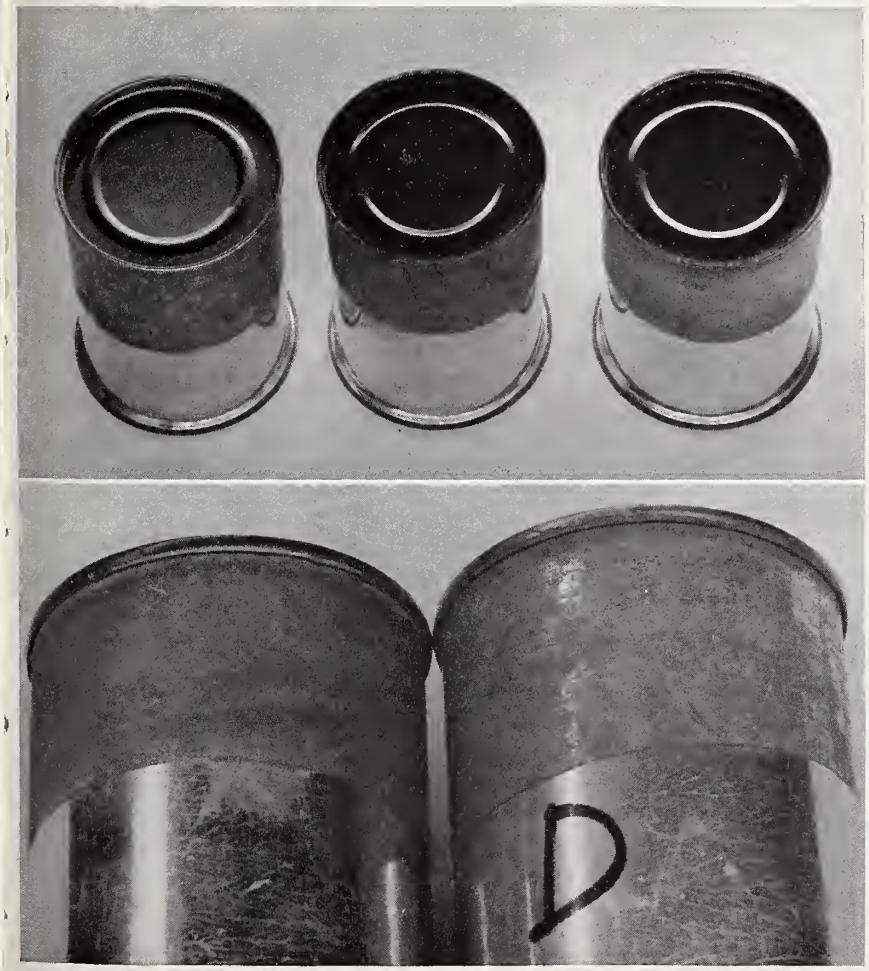
The films are flexible, withstand heat, and resist abrasion, alkalis, acid, and such solvents as alcohols, mineral oil, and benzene—all properties needed in metal coatings. These properties also suggest soybean- and linseed-oil films for adhesives and concrete and masonry paint.

Research that led to these oil derivatives, called vinyl ethers, was done at the ARS Northern Utilization Research and Development Division at Peoria as part of the overall evaluation of agricultural commodities as sources of metal coatings. Chemists H. M. Teeter, L. E. Gast, and J. C. Cowan, chief of the oilseed-crops laboratory, directed the work.

Although vinyl ether films still are in the laboratory stage of development, the scientists have demonstrated that these films adhere especially well to black iron and aluminum. Disks stamped from metal covered with the films were formed into lids or ends and crimped into place on can bodies without breaks in the films.

To make the new film materials, Northern Division chemists reacted fatty alcohols—commercially produced from soybean and linseed oils by chemical reduction with sodium—with welding-grade acetylene to produce vinyl ethers. The molecules of the vinyl ethers were joined together by another chemical reaction—polymerization—to produce giant molecules, which make up the film-forming materials.

The vinyl-ether polymers and copolymers are colorless to pale-yellow viscous liquids that cure by baking or air drying to form almost colorless to amber films. Hardness, chemical resistance, and other properties of these films vary, depending on the parent oil, method of curing, and added ingredients used in them.☆



CAN ENDS (above picture) of aluminum, chemically treated black iron, and untreated black iron (as shown from left to right) were coated with a vinyl ether made from soybean oil. Film withstood crimping onto can body without cracking. Identical cans in picture below were similarly coated and top crimped on. Commercial coating at the right cracked under the strain. But the vinyl-ether coating at left withstood the severe test of crimping without damage, showing its potential for this use.

NEMATODE CONTROL for LONG-STAPLE COTTON

Soil fumigation gave greater lint yield and lower nematode count. DBCP is costliest but most effective chemical used

■ A CHEMICAL METHOD of controlling the root-knot nematode on extra-long-staple cotton now joins crop rotation and summer fallow as a practical means of dealing with this pest.

In recent Arizona studies with several soil fumigants, all treatments raised yield significantly, and DBCP (1,2-dibromo-3-chloropropane) gave highest yield, lowest nematode count.

Rotation of cotton with a nematode-resistant alfalfa for 2 or more years is a useful control measure, as is a rotation with small grain and grain sorghum on the land for a year—small grain during the cool months, followed by grain sorghum.

Equally effective is fallowing the land, occasionally disking it during the hot months. This reduces nematode survival by keeping the soil dry, and starves nematodes by getting rid of weeds they feed on.

Unfortunately, some growers can't justify these practices because of acreage limitations or for other reasons. Preplanting soil fumigation would seem to be their answer.

ARS nematologist H. W. Reynolds, of USDA's Cotton Research Center, Tempe, Ariz., fumigated test plots with several nematocides. These were injected about 8 inches deep and the soil compacted with a roller. The cotton was planted 8 days later.

Treatment soon showed effect

Other plots were treated with DBCP adsorbed on clay granules, applied with a fertilizer drill as a side dressing 2 months after planting. Still other plots weren't treated.

Differences in plant size were obvious 4 weeks after seedling emergence. Cotton plants in fumigated plots were larger and more vigorous than those in the other plots. These differences were even more pronounced 10 weeks after emergence.

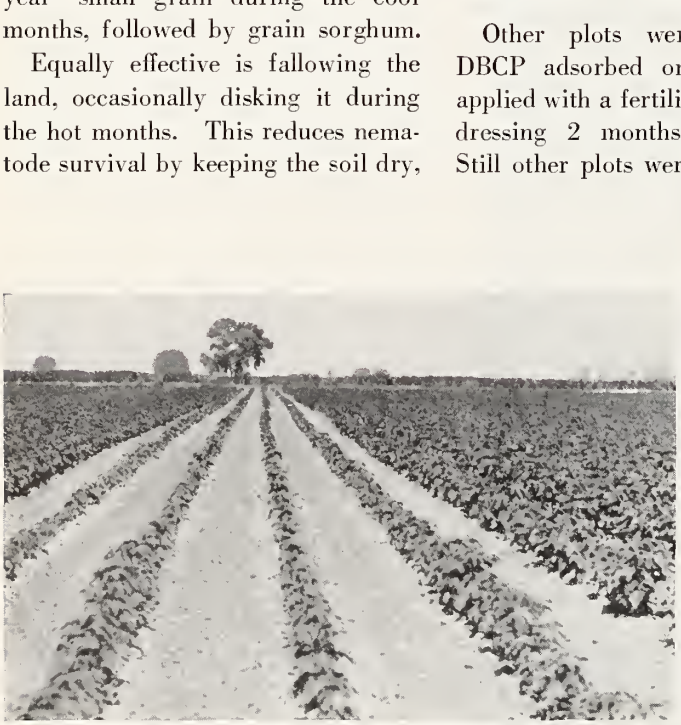
Six months after planting, all the plots were harvested with mechanical pickers and seed cotton weights determined. Plants from each plot were selected at random and examined for root-knot nematodes.

All nematocides raised yield

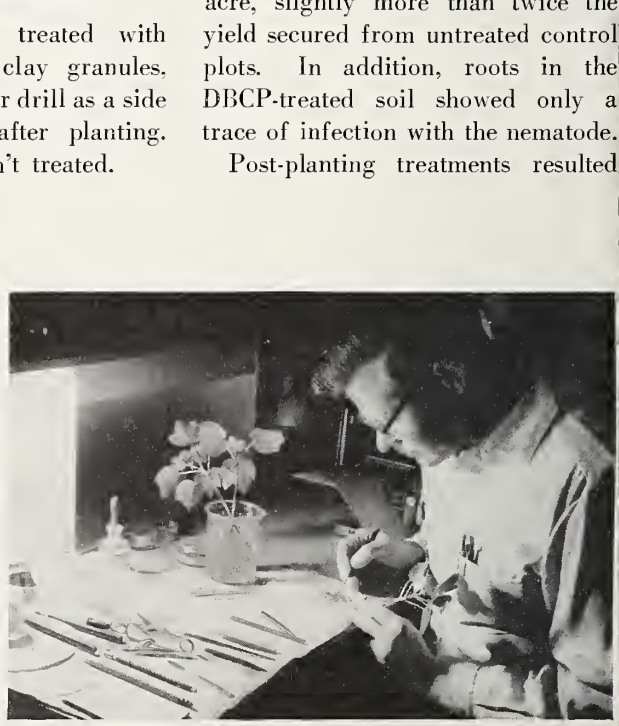
Yields of cotton from soil-fumigated plots were considerably greater and nematode counts much lower than those of the untreated plots and plots treated *after* planting. The post-planting treatment gave better results than no treatment at all.

Plots treated with 4 gallons per acre of DBCP (17.3 pounds of active ingredient per acre) before planting produced 1,041 pounds of lint per acre, slightly more than twice the yield secured from untreated control plots. In addition, roots in the DBCP-treated soil showed only a trace of infection with the nematode.

Post-planting treatments resulted



CONTRAST in plant size shows damage by nematode and value of soil fumigation. The plot at left got 4 gallons of DBCP per acre, plot at right, 3 gallons, and center plot, none.



COTTON roots are examined by ARS nematologist J. H. O'Bannon for the debilitating root-knot nematodes. Randomly picked plants were rated to show extent of infection.

a yield of only 514 pounds of cot-
n per acre. Infection with root-knot
matodes was moderately heavy.

At the 4-gallon rate, DBCP cost
out $22 per acre. Application cost,
e same for all chemicals used in the
sts, was $3 per acre. The other
emicals ranged in cost from about
3 to $18, depending on the chem-
als and amounts used. Although all
the nematocides raised lint yields,
e more expensive DBCP increased
em most of all.

Following treatment with DBCP,
matode infestations built back up
the soil to the point that there were
benefits in the second-year crop.

Row placement of the chemical
tually fumigates a band down the
ed row 2 feet wide, protecting
unger cotton and getting the plants
f to a good start. Later in the
ason, the roots push out into the
nfumigated soil and will then show
me root-knot nematode infections.
ut this won't weaken the large cotton
ants to any great extent. The im-
rtant thing is to protect plants while
ey are in the seedling stage.

est damages, doesn't kill

Root-knot nematodes by themselves
unt but never kill cotton plants, al-
ough combinations of the nema-
des and certain fungi may kill the
edlings. The immediate effect of
is nematode is the formation of
ots or galls on the roots. Roots are
orter and have fewer lateral feeder
ots than normal. Because the root
ssues are so disarranged, they are
efficient in conducting water and
utrients. This places the plant under
ress and it often wilts during the
eat of the day.

Nematode eggs and larvae are
read through the field by irrigation
ater, infested crop residues, and by
il adhering to farm machinery.
Vaste water from a field can carry
ie parasite to other fields, and often
other farming areas.☆

GRAINS of hull-less barley (left) pack more to the bushel than grains with hulls (right) produced by standard varieties.

A BARLEY for FOOD and FEED

HULL-LESS BARLEY, developed from introduced Asian varieties by USDA-State research, looks promising as a feed and food crop.

Most of the barley now grown in the United States has tightly attached hulls. Two-thirds to three-fourths of our national production is grown for feed, for which hulls aren't necessary. The remainder is used mostly by the malting industry, which does require barley with hulls.

The new barleys, which yield as well or better than commercial barleys, offer more feed value per pound than the latter. Hulls take up space and weight but have little feed value. Hull-less varieties weigh 60 pounds or more to the bushel, standard barleys, 48 pounds. So hull-less barleys would decrease handling and storage costs per unit of nutrition.

Protein content of the hull-less varieties is 1 to 3 percent higher than that of standard barleys. And in poultry feeding tests, hull-less barley with supplements gave the most economical gains of any cereal. Although chicks fed on barley alone showed some loss in vigor, soaking the barley before feeding, or adding vitamins and animal fats overcame the deficiency. The soaking starts enzyme action which breaks down constituent compounds into more readily available nutrients. Additional feeding trials are being made with laying hens and cattle.

Because of the cost of removing hulls, little barley is used in the United States for human consumption. Food manufacturers are testing the hull-less varieties, however, for puffed, rolled, and ground barley.

The hull-less barleys were bred by ARS agronomist R. W. Woodward, working with the Utah Agricultural Experiment Station, Logan. He crossed Asian hull-less varieties with leading U.S. commercial varieties. Field trials have shown that selected hull-less barleys compare favorably with hulled barleys in disease resistance, threshing quality, and yield. The new barleys have been released for growing this summer.☆

GULLIES like this are a major source of sand and silt carried in waterways, deposited on river bottoms or fields.

WHAT SEDIMENTATION IS DOING

Movement of sand and silt that ruin land downstream is challenging scientists

UNDERSTANDING OF THE LAWS that govern the tra... portation and deposition of solid particles by water ... be a step toward overcoming this major difficulty in p... tions of the Mississippi Valley from Illinois to Louisia... Studies under the direction of USDA hydraulic engin... R. Woodburn will be aided by facilities of a laborat... now under construction at Oxford, Miss.

The sand and silt carried by streams represent two f... damage. First, soil is lost from fields in the watersh... Second, much of this material, without its nutrients, ... be deposited on other lands downstream, causing th... to go out of production. It's the latter damage that p... marily concerns this laboratory.

Stream bottoms common to this area are covered w... a flat layer of infertile material—sand and silt. In ti... these sand-bed channels fill to the point that even sm... rains cause the streams to go over their banks into ... joining fields, where more sand and silt are deposit... This infertile material eventually forces the fields out ... production. As the sand splay continues to grow, ... forms a valley plug that moves slowly upstream, ruini... more and more land.

Sedimentation is also considered a major factor in ... design of dams. Some are built for the prime purpose ... trapping sand and silt, which would damage much la... if allowed to continue downstream. Dams that are ... signed to store water often trap sediment also, thus red... ing their water-holding capacity.

A scouring process sometimes develops below the dam ... In one case where about 15 acre-feet of sediment ...

FLAT, SAND-BED channel common to Mississippi Valley. Small ripples in sand are normally found when water velocity is low. Streams carry considerable water after storms.

STANDING WAVES appear in East Goose Creek, near Oxford, Miss. Waves (often several feet high) build up, crest, recede—moving neither up nor down stream—in high-velocity part of channel. Bottom shape is similar.

ped by a dam, almost an equal amount of sand and was picked up downstream. The cause and effect of phenomenon are not yet understood.

pparently, flat sand-bed channels do not always be- according to the hydraulic rules for channels with l boundaries such as are found in most areas. There ears to be a high degree of variability in the friction t of the streambed on the waterflow. So the rate of harge is not necessarily fixed for a given stream h. Since the friction of the streambed may change, discharge may vary widely with no corresponding nge in water depth.

RS scientists at Oxford believe that when there is e flow, small ripples or dunes are formed in these d-bed channels, presenting a high-friction surface to water. The ripples closely resemble those formed in d at seashores or lakefronts.

However, when the velocity of the water increases, sand toms become flat and offer little resistance. As the ocity of the stream further increases, the bottom takes a wavelike shape, scientists believe.

sterious standing waves under study

This factor is of interest to the scientists because of nding waves that form in the water. So far it is not own how or why these waves form and what action y have on the transportation of sand and silt.

In addition to river bottom shape, the movement of d particles on the surface of the streambed and just ove it is under study. Some scientists feel the streambed may be plastic in nature with no distinct demarkation point between the flowing water and the stationary particles at the bottom of the channel.

To help find the answers, the Oxford laboratory is being equipped with a tipping circulating flume 100 feet long. The flume—4 feet wide and 2 feet deep—will pivot on a center point to a maximum of 1 percent slope, duplicating the slope of local streams.

Laboratory stream shows water action

A large pump will circulate 7,000 gallons of water per minute through the flume and scientists will be able to observe the action of the water and sand through windows along the side of this laboratory stream.

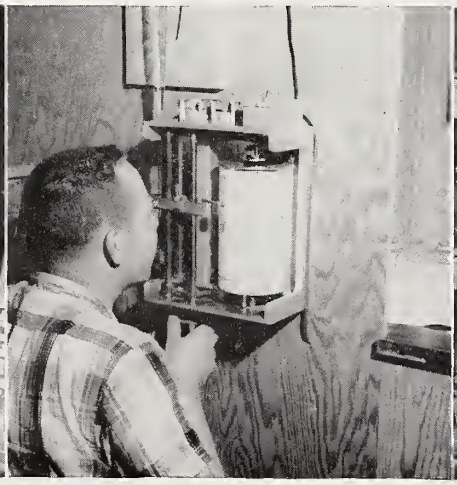
To obtain information about sand-bed channels in natural watersheds, scientists have installed gaging stations on channels with watersheds varying from about 100 acres to 117 square miles. At these selected points, stream depth, velocity, and amount of soil or sediment being carried by the water are measured.

Movement of sediment is checked by placing a bottle in a special fish-shaped holding device and lowering it into the stream at a fixed rate to collect a representative sediment sample from the surface to the stream bottom. This material is analyzed for weight and particle size distribution. These data are then correlated with measurements from the gaging stations.

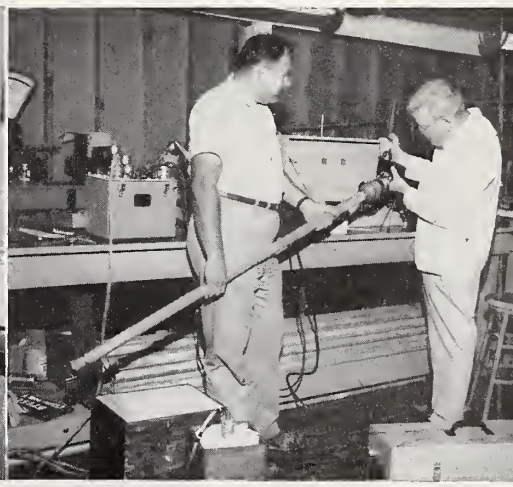
The scientists feel that understanding the movement of sand and silt in sand-bed channels will lead to better recommendations for this and other areas.☆

AMPLES are treated to make then water is decanted. Material , weighed, analyzed. Samples are gaging stations on watersheds.

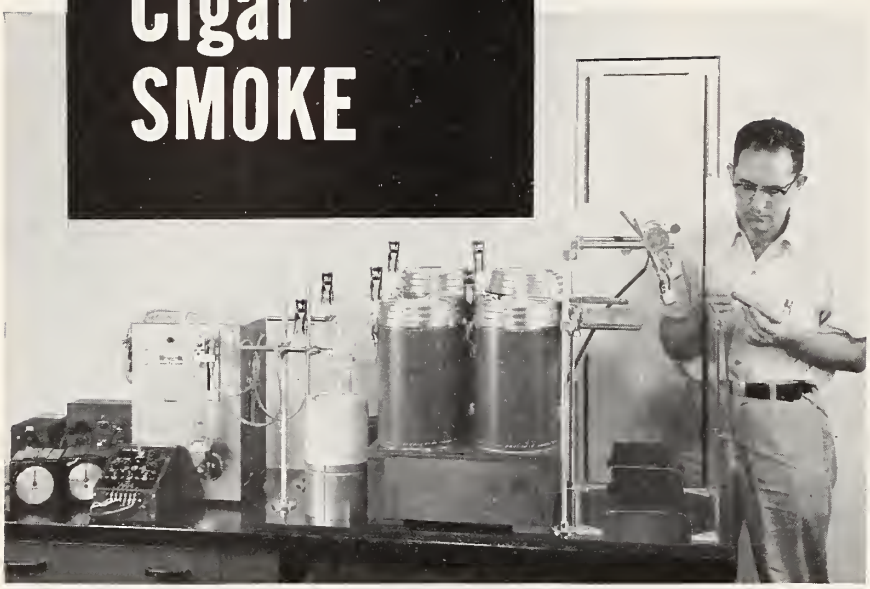
PERCENTAGES of various size particles of sand, silt in sediment are determined. Size is measured, recorded on revolving drum as particles fall past eyepiece.



EQUIPMENT utilizing radioactive isotopes will allow more rapid, accurate measurements of moisture, sediment movement. Particles of radioactive glass may be used to trace sand.



Testing Cigar SMOKE



CHEMIST A. I. Schepartz fits cigars to smoking machine, which supplies condensed smoke for analysis.

Chemist shows there's more than poetry in the essence of a good cigar

■ FLAVORFUL, FRAGRANT smoke—the real thing a cigar smoker consumes—is just beginning to yield some of its mystery to researchers.

Knowledge of the components of smoke that are responsible for its taste and aroma will give cigar manufacturers for the first time a scientific basis for their choice of tobacco blends. It may also give breeders important leads for the development of new strains of tobacco.

We know a lot about cigar-tobacco *leaf*, but curiously enough the *smoke* itself has been largely neglected as a subject for scientific inquiry.

Tobacco smoke is a fantastically complex mixture. Chemists believe it may contain as many as three or four hundred different compounds. Some work has been done to identify these, but it has mainly concerned cigarette smoke. Now, an impressive start has been made in the analysis of cigar smoke by chemist A. I. Schepartz at USDA's Eastern utilization division at Philadelphia, Pa. Schepartz is working under a research fellowship supported by the Cigar Manufacturers Association of America.

Machine collects the smoke

To collect samples for analysis, Schepartz has developed a machine to smoke the cigars for him. In fact, it smokes two at a time, and at a controlled rate of a puff a minute. And the smoke is probably one of the coolest on record, for it is chilled in refrigerated glass tubes to −94° F. At that temperature the smoke condenses inside the tubes. Most of the condensate is soluble in ether and the rest in methyl alcohol, so rinsing the tubes with these solvents removes all of the condensate for analysis.

Then begins the painstaking work of separating this complex mixture into its pure constituents. It involves first, gross chemical fractionations, then a succession of chromatographic separations. Schepartz is using column chromatography, in which compounds in solution are filtered down through a tube, or column, of finely powdered adsorbents. The compounds come out of solution in sequence, forming distinct bands in the column. But even these do not represent pure substances.

Fractions are redivided

Schepartz washes out the material in each band for a finer separation by *paper* chromatography. When each solution is applied to a sheet of chromatographic paper, the various components proceed along the surface of the paper by capillarity, and collect at different distances from the starting point. This leaves spots that are visible in ultraviolet light. Comparison of the spot patterns with those made by known materials gives the chemist a basis for identifying each substance.

Thus far, Schepartz has identified a number of carbonyls in cigar smoke. He is interested in these compounds because they contribute to the smoke's flavor. Schepartz has also discovered a compound known as hentriacontane, which was found previously in cigarette smoke. The compound is present in tobacco leaf to the extent of about 3 percent.

Other studies will follow

The discovery of these few specific components marks the beginning of a long-term analysis of cigar smoke, which promises to reveal many heretofore unknown facts about cigars, and should point the way to improved products for millions of smokers.☆

Chlorosis from Virus and Salt can be Curbed

A chemical helps citrus trees pick up iron from soil and restore normal leaf color

A HIGHLY EFFECTIVE iron chelate, Sequestrine 138 Fe, corrected iron chlorosis of citrus which showed iron deficiency symptoms as a result of virus infection, salt injury, or from being grown in calcareous soils in the Texas Rio Grande Valley, in USDA-State research.

A chelate (keylate) is a soluble organic compound with a ring structure that holds a metal atom between two or more other atoms, shielding it from soil ions that make soil metals insoluble and unavailable to plants. High-salt soils tend to tie up iron. In addition, cachexia, a virus disease, often impairs citrus roots and thereby causes iron starvation and results in leaf chlorosis. Certain rootstocks, too, pick up iron less efficiently.

ARS and the Texas Agricultural Experiment Station, at Weslaco, tested Sequestrine 138 Fe's effect on chlorosis resulting from all three causes on 12-year-old Red Blush grapefruit on Pina, Suwannee, Sunshine, and Sampson tangelos and Citrumelo No. 4475 rootstocks on high-lime soils in the Weslaco orchard.

All trees had the cachexia virus, and those on Pina, Suwannee, and Sunshine tangelo rootstock showed pitting and gumming of the rootstock characteristic of the cachexia disease and iron chlorosis of the scion top.

Though carrying cachexia virus, trees on Sampson tangelo and Citrumelo No. 4475 rootstocks showed no cachexia symptoms, but their scion tops showed from iron chlorosis.

Trees on all rootstocks responded to chelate

Three trees, uniformly affected with iron chlorosis, were selected on each rootstock variety for treatment. One tree was treated with one-half pound of Sequestrine 138 Fe, another with 1 pound, and a third was not treated. The material was sprinkled on the ground at the trees' drip line and chopped into the soil with a hoe.

It corrected iron chlorosis and its effect lasted from April 7, 1958, into the next growing season. On February 7, 1959, treated trees had two extra flushes of growth and were luxuriant and green. Untreated trees were almost defoliated from iron chlorosis and did not grow after April 7, 1958. Chlorosis on the trees free of cachexia symptoms probably was due to calcareous soil—while chlorosis on cachexia-affected trees may have been caused by that disease alone or in combination with the high salt or calcareous soil.

Regardless, Sequestrine 138 Fe was equally effective on both cachexia-affected and healthy trees.

Chemical also aided salt-induced chlorosis

The second experiment, with salt-induced iron chlorosis, was conducted on 6-month-old sour orange seedlings on Suwanee rootstocks in a Weslaco nursery. The soil was slightly calcareous and heavily salted from irrigating with well water carrying 2,800 parts per million total soluble salts. Sour orange seedlings in calcareous soil seldom show iron chlorosis, but about half the leaves in this group showed it on July 14, 1958.

Sequestrine 138 Fe was applied in a furrow 6 inches from the seedlings, spaced about 3 inches apart in the nursery row, at 8 to 170 grams per linear foot of row.

In this experiment, the plants were observed for only 2 months, but chlorosis was much less in treated plants than in untreated. The new flush on the untreated seedlings showed chlorosis, but that on the treated seedlings did not.

Some chlorosis persisted on old foliage on the treated seedlings and it is not known whether these leaves later regreened. Although iron chelates may correct salt-induced iron chlorosis, the disorder is only one symptom of excess salt.

Analysis of the saturated extract of the soil at the end of the two months showed a salt-excess condition which could injure citrus roots, reducing the ability to absorb iron and causing iron chlorosis.☆

RED BLUSH grapefruit trees here were equally chlorotic due to cachexia virus at start of study. Ten months before pictures were taken, tree at right received a soil treatment of 1 pound of Sequestrine 138 Fe, accounting for the recovery shown here.

STERILANT OF MANY USES

Ethylene oxide aerosols prove their great value as sterilants and fumigants, now that they're safe to use

GASTIGHT autoclave safely, quickly, and effectively sterilizes toys. Large, walk-in type autoclaves could be used for large hospital items.

EFFECTIVENESS of ethylene oxide as grain fumigant is shown by these year-old samples of wheat. Treated grain at the left shows no damage. Other sample isn't treated and shows the damaging effects of various organisms.

AEROSOL-DISPENSED ethylene oxide is shaping up as one of our most important sterilizing compounds, with potential applications ranging across agriculture. medicine, pharmacology, industry, and recreation.

This has been possible only since USDA, working in cooperation with the U.S. Army Chemical Corps, developed a safe method for handling the flammable compound by combining it with dichlorodifluoromethane.

Moreover, ARS chemist R. A. Fulton and his staff of the Agricultural Research Center, Beltsville, Md., developed these formulations especially for packaging in the small, lightweight, inexpensive, low- or medium-pressure aerosol containers.

The compound isn't new to chemists or entomologists. It has long been used as an insecticide, and was known to have sterilizing properties at high concentration. But its use has always been limited by the dangers of explosion and fire. Since these hazards were removed, however, interest in its use has mushroomed.

It's especially effective for sterilizing materials that are too sensitive to heat or other chemical treatment—photographic film, clothing, bedding, delicate instruments, pharmaceutical products, and plastic materials, for example.

The gas mixture kills every virus and bacterium against which it has been tested, leaves no residue, and sterilizes at a wide temperature range (70° to 140° F.).

But there are some limitations, too. Manufacturing costs are high due to limited production, although ethylene oxide itself is not expensive. As manufacture and use increase, however, costs should come down. And ethylene oxide, being a penetrating gas, must be used in gastight enclosures. It has been used in gastight rooms, treated plywood rooms, autoclaves, and other tight-fitting containers such as polyethylene bags.

Ethylene oxide is already being used at USDA's tile-walled Plum Island (N.Y.) Animal Disease Laboratory to guard against escape of the highly contagious foot-and-mouth disease virus, and as a routine sterilant at the Army Biological Warfare Laboratory at Fort Detrick, Md.

Many uses are opening up

The chemical's effectiveness as a grain fumigant and soil sterilant has been shown. Other *potential* uses to agriculture are many—sterilization of milking equipment, maintenance of sanitary conditions in and around barns, fumigation of plants for pest control, and food sterilization. Uses may increase as new areas of application open up.

The compound has already been used to sterilize some packaged foods, could be used for many more, and is being investigated for steriliz-

ng bedding, furniture, rental shoe kates, and swimming suits. Barber nd beauty shop equipment could be afely and effectively sterilized.

Iospital use is possibility

One of the most important uses nay be in hospitals to help shut off reservoir of infection from anti-biotic-resistant bacteria, especially staphylococci. After use, blankets, nattresses, linen, bedclothes, utensils, toys, and other possible infective sources could easily be sterilized in either walk-in type autoclaves or gas-tight rooms.

The hard-to-control staphylococci are quickly killed by the ethylene oxide mixture, regardless of how inaccessible the bacteria may be.

Eventually it should be possible to sterilize hospital rooms. Only difficulty at present is the fact that the gas is "fugitive" and escapes readily through windows, porous walls, and cracks. Fulton has developed a model which shows how gas can be disseminated into a room to be sterilized, once it can be made gastight.

Aerosol is used industrially

Industrially, ethylene oxide aerosols are proving useful in destroying unwanted bacteria spores during penicillin manufacture, and in sterilizing drugs and drug containers.☆

A GUIDE TO PORK QUALITY

Criteria are being developed through objective measurements and taste panel judgments

■ MARBLING IN THE LOIN MUSCLE seems to be a good indicator of pork quality. USDA food specialists Olive M. Batcher and Elsie H. Dawson found that juiciness and tenderness of the muscle of cooked pork loin and rib roasts and two muscles of cooked ham were related to the degree of marbling in the loin muscle.

The research was done in the ARS Institute of Home Economics at Beltsville, Md., to develop basic information on how fat content affects the cooking quality of fresh pork prepared by roasting in a 325° F. oven. Loin and ham cuts from both fat-type and lean-type hogs were used in the research.

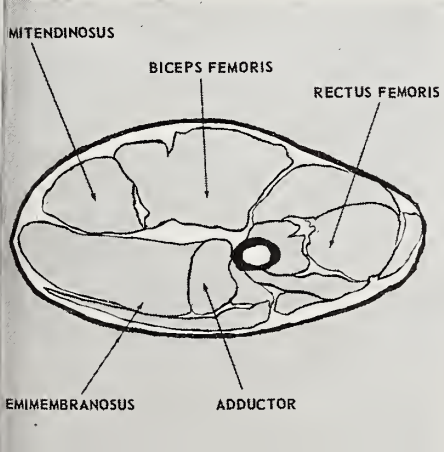
Marbling of fat determined visually in loin muscle closely paralleled the amount of fat, determined by ether extract, in the loin but not in ham. Different muscles of the same carcass varied in fat content so that the fat of one muscle did not always indicate the fat in others. The amount of fat (by ether extract) in ham muscles was not related to the tenderness and juiciness of the cooked meat. Because ham muscles vary so greatly, more than one muscle should be used to estimate the quality of the whole ham. Also, fat within the muscle was not related to backfat thickness on a hog carcass.

Tenderness in hams and loins from both fat-type and lean-type hogs varied widely. The most tender raw muscle was the *adductor* in the ham; the least tender, the *biceps femoris*. When cooked, the *semitendinosus* muscle was the most tender, and the *semimembranosus* the least.

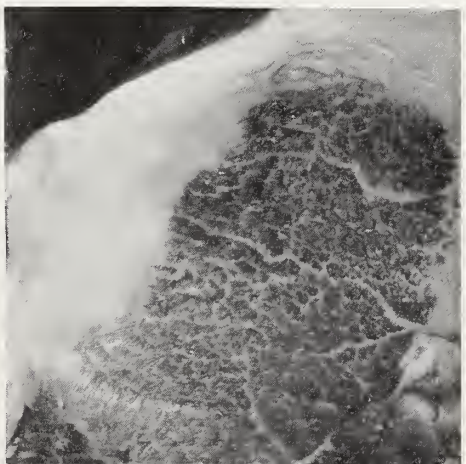
Flavor scores were similar for ham muscles from lean-type and fat-type hogs. Color of raw lean meat was not found related to breed, backfat thickness, or marbling.

Because quality varied, data on more carcasses are needed to obtain an accurate estimate of relationships of various quality factors of raw and cooked pork.☆

HAM cross section shows various muscles tested for tenderness.



ABUNDANT MARBLING in pork loin muscle (left) promises meat from this carcass will be more tender and juicy than meat with slight marbling when cooked by standard methods. (Picture on cover shows operator measuring muscle tenderness with a Kramer shear press.)



OUR HUNT FOR NEW INSECT PESTS

Everyone can help in this stepped-up effort to spot potential threats in time

New insect pest is found . . .

Find is reported to . . .

Extension worker

State experiment station

State or Federal entomologist

Action is started . . .

Survey

Research

Control

If you find a new or unusual insect, USDA and State entomologists want to know about it. Dead insects can be sent for identification to county agents, agricultural experiment stations, or entomological field workers.

The ARS Plant Pest Control Division is strengthening detection work to find pests that may have newly slipped in from other countries or are spreading into new areas where they have not been established before.

Many of our most destructive crop and forest pests came from other countries. If they had been discovered when they first arrived, they could probably have been eradicated without great cost. But, allowed to propagate and spread, they are now major threats. For example, the European corn borer, first found here in 1917, last year destroyed over 11½ million bushels of corn and continues to spread throughout the country. Other costly imported pests are pink bollworm, gypsy moth, Japanese beetle, khapra beetle, and white-fringed beetle.

On the other hand, the Mediterranean fruit fly, citrus blackfly, and Hall scale were eradicated because an effective campaign was undertaken on discovery.

In the stepped-up detection plan, ARS will coordinate and make best use of work being done by various organizations and make suggestions for expanded activities.

The agency will—

. . . Call on all entomologists—Federal, State, private, and military—to aid in the search for pests.

. . . Ask all citizens to participate, including farmers, 4-H'ers, scouts, foresters, and millers.

. . . Hold training schools to teach entomologists and allied workers better detection methods.

. . . Issue detection guides with suggestions for where and when to look, and descriptions of species.

. . . Issue information on insects not now known to occur in the United States.

. . . Improve identification aids.

When we find an important insect that offers a potential threat, ARS and State entomologists immediately evaluate the matter and take appropriate action. They make surveys to determine the extent of the infestation and, if warranted, apply such measures as quarantine and control to contain or eradicate the pest.☆

Way to extract nitrogen

Dctergents are being used to remove nitrogen from plant materials in analyzing for protein. A. Bevenue and K. T. Williams, of USDA's Western Utilization Research and Development Division, Albany, Calif., have extracted 92 to 95 percent of the nitrogen from beans and peas with aqueous solutions of detergents containing sodium carbonate. They used two detergents—sodium dodecyl sulfate and an alkyl aryl sulfonate. Each was effective without sodium carbonate but more effective with it.

An advantage is the mildness of the reaction. It has no effect on other plant components. After removal of nitrogen, polysaccharide fractions can be prepared easily.

New ports to guard

The St. Lawrence Seaway is bringing foreign plant and animal pests close to the center of America and complicating USDA pest control.

Khapra beetles (dreaded stored-grain pests) found on a freighter putting in at Cleveland near our grain belt emphasized the point. Previously, the khapra beetle had been found only in our Southwest, and Federal-State officials are trying to eradicate it.

Importers and exporters along the seaway are urged to become familiar with inspection and treatments necessary for dealing in agricultural products and to cooperate with U.S. Customs and ARS inspectors. These together with Canadian regulatory officials are trying to prevent entry of all foreign insects, diseases, or other pests harmful to crops and livestock.

Fruits, vegetables, other plant products, meats, and animal byproducts brought in cargo, passenger baggage, and ships' stores (including ships' garbage) are subject to surveillance. Also, exported plants,

plant products, livestock, meat, and animal byproducts such as hides, meat scraps, and tallow are examined so that they meet entry requirements of the countries of destination.

Hall scale may be gone

Hall scale, an insect pest of fruits and nuts, has not been found in this country since 1957. If none turns up in the next 12 months, USDA will consider it eradicated.

Infestation has been confined to the Chico, Oroville, and Davis areas of California and damage has been light. Unchecked, the pest eventually could have done vast damage to our $267 million stone-fruit industry.

ARS and California State Department of Agriculture scientists have carried on intensive inspections for many years and destroyed or fumigated all infested host trees.

Only destruction of trees or fumigation has been entirely effective.

Surveys will continue until 1960 to make sure that the last living insect has been eradicated. To prevent reinfestation from foreign-grown plants and fruits, plant quarantine inspectors continue to keep watch at U.S. ports.

Two apricots do well

Two Turkish apricot seedlings now being tested by USDA scientists in California hold more than usual interest for breeders because of their distinct resistance to adverse weather conditions during flowering.

The apricots are also known to have some resistance to brown rot, shot hole, and bacterial canker.

For over 10 years, the introductions (known by number only) produced at least a fair crop each year, even when commercial varieties were severely damaged by frosts or rainy weather. But neither variety can be classed as commercially acceptable as yet, because the fruits are small and they tend to drop before maturity.

Two-year-old seedlings resulting from natural pollination have made vigorous growth as a group, but have varied considerably in size. The plants can apparently set fruit under adverse pollinating conditions as well. This may result partly from their apparent resistance to diseases affecting the blossoms.

Scientists hope that in addition to the traits already found, they will be able to find other desirable genetic characteristics that can be utilized in breeding.

Test for eastern wool

A device to determine clean fleece weight of western range sheep is being adapted by USDA for use on eastern flocks. The "squeeze box," as it's known, discounts cleaning shrinkage and can quickly tell a sheepman which animals to keep for upbreeding his wool productivity.

The device is easy to operate and can be used on all sheep in any flock to give breeders reliable differences in clean-wool weight at shearing.

Animal husbandman P. E. Neale, of the New Mexico Agricultural Experiment Station, developed the original squeeze box for use with western wool breeds. ARS sheep geneticist

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G. M. Sidwell at Beltsville, Md., is calibrating the device to adjust for mutton-breed fleeces. Even without calibration, the box ranks sheep in a flock for wool productivity.

The squeeze box measures the volume of wool at a constant pressure. Fleece is put in a chamber 8 inches deep and 30 inches in diameter. The lid is closed and a belt inside tightened to a standard pressure. This reading can be converted by means of a table to clean-fleece weight.

New lima resists mildew

Thaxter, new lima bean resistant to downy mildew, is fast gaining favor on the eastern seaboard.

The good-quality, high-yielding bean is welcome here because downy mildew is a major disease, capable of damaging up to 75 percent of the crop from New York to Virginia.

Thaxter was developed by horticulturist R. E. Wester, of USDA's

Beltsville, Md., research station, and plant pathologist R. C. Cetas, of Cornell University's vegetable research station at Riverhead, Long Island.

The new bean was released last year. This year seed firms were able to supply about 500,000 pounds of seed, enough to plant 12,500 acres.

Color, flavor, tenderness, and texture are acceptable for canning and freezing. Thaxter's qualities are comparable to those of currently popular, small, green-seeded lima beans.

A large vegetable processing firm in New Jersey that contracts with many growers in several States is already planting Thaxter widely. Other eastern processors and growers are expected to plant Thaxter.

East has new soybean

Hill—a widely adapted new soybean with many desirable characteristics—has just been released.

The new soybean is high-yielding, early-maturing, and resistant to lodging and shattering of pods. It's resistant to bacterial pustule, wildfire, and frogeye—major soybean diseases—and to Phytophthora rot, a fungus attacking stems and roots. Hill is also resistant to purple seed stain and shows some resistance to the root-knot nematode.

The Agricultural Experiment Stations of 12 Southeastern States cooperated with USDA in the development and testing of the new soybean.

Hill is adapted to Delaware, Maryland, Virginia, North Carolina, Missouri, Arkansas, Mississippi, Texas, and New Mexico. Initial stocks of seeds are now being produced in these States and should be generally available for planting in 1961.

In field trials at 30 locations, Hill yielded an average of nearly 35 bushels per acre on the east coast, almost 33½ bushels in the Mississippi Delta area, and just over 25½ bushels in Central and Southwestern States. Beans from all plantings contained an average of almost 39½ percent protein and just over 21 percent oil.

Pest is hunted by plane

A spotter in an airplane is extending the range of our search for possible new areas infested by the soybean cyst nematode. This minute but destructive and hard-to-control root feeder is spreading in most soybean areas where it is established.

The aerial surveyer notes signs of nematode damage—yellowish areas and sparse growth in soybean fields. Ground crews sample the soils in suspected locations, examine roots of

the stunted plants for nematodes, and mark the outer limits of infestation.

The pest infests three areas. One includes parts of Arkansas, Missouri, Kentucky, Tennessee, and Mississippi. Another is along the southern coast of North Carolina. And the third is in northeastern North Carolina and southeastern Virginia. All 26 major soybean-producing States are being surveyed.

Japanese nematologist Minoru Ichinohe, now studying under a Rockefeller grant, will visit infested areas and give growers and scientists knowledge the Japanese have gained in years of combating the pest.